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ENGINEERING DESIGN FILE

Project/Task	WAG-7 Pits and Trenches RI/FS		
Subtask	Surface water	EDF Page 1 of 25	

TITLE: SDA Surface Water Description and Data

SUMMARY

The summary briefly defines the problem or activity to be addressed in the EDF, gives a summary of the activities performed in addressing the problem and states the conclusions, recommendations, or results arrived at from this task.

The following two summary reports discuss the surface water at the SDA and surface water data collected near the SDA as part of a continued environmental monitoring program for the site. These summary reports are in support of the remedial investigation study for the SDA.

Distribution (complete package):

Distribution (summary page only):

Author Karen N. Keck Karen N. Keck	Dept. 4/19/95	Reviewed S. O. Magnuson S. O. Magnuson	Date 4/19/95	Approved	Date 5/5/95
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SURFACE WATER

Surface water near the SDA consists of the Big Lost River, 3.2 km (2 mi) to the north, the INEL diversion area, 1.6 km (1 mi) to the west, local basin surface runoff from the surrounding slopes of the SDA, and precipitation falling directly on the SDA.

Big Lost River Drainage Basin

The SDA lies within the Big Lost River drainage basin. The termination of this drainage is in the northwest part of the INEL (Figure 1). The Big Lost River is an important source of irrigation water for agricultural areas west and northwest of the INEL. Streamflows are often depleted before reaching the INEL by irrigation diversions and infiltration losses along the river. However, in times of heavy runoff, the river flows to its terminus in the Big Lost River Sinks at the northwest corner of the INEL. During these high flow years, the Big Lost River is an important source of recharge to the Snake River Plain aquifer. The Big Lost River last flowed onto the INEL for a few days in the early spring of 1993. Prior to that, it had not flowed onto the INEL since 1986, partly due to the prolonged drought conditions in southeastern Idaho and increased upstream irrigation demands for the water.

The main stem of the Big Lost River is formed by the confluence of its East Fork and North Fork about 35.4 km (22 mi) northwest of Mackay Dam, which impounds the river flows approximately 6.4 km (4 mi) northwest of Mackay. A significant portion of the streamflow is controlled by the dam, which stores runoff for irrigation.

The Big Lost River flows southeast from Mackay Dam down the Big Lost River Valley, past Arco, and onto the Snake River Plain. During high flows the river may flow onto the southwest portion of the INEL. Here, the river flows northward across the INEL in a shallow, gravel-filled channel or is diverted to the INEL diversion area. Two 1.8 m (6-ft) diameter corrugated metal pipes allow for passage of less than 25.5 m^3/s (900 ft^3/s) through the dam downstream into the main channel (Lamke, 1969). The main channel branches into several channels 29 km (18 mi) northeast of the INEL diversion dam, forming four shallow playas, referred to as the Big Lost River Sinks.

The INEL diversion area was constructed in 1958 to divert high runoff flows from the INEL facilities. The diversion system consists of a diversion dam, diversion channel, two 1.8 m (6-ft) diameter gated culverts, three dikes, four spreading areas, and two interconnecting channels (Figure 2). Flow in the diversion channel is uncontrolled at discharges that exceed the capacity of the culverts. The diversion channel is capable of carrying 204 m^3/s (7,200 ft^3/s) from the Big Lost River into the spreading areas. Two low swales located southwest of the main channel will carry an additional 59 m^3/s (2,100 ft^3/s) for a combined diversion capacity of 263 m^3/s (9,300 ft^3/s) (Bennett, 1986).

Spreading Area B, with a top dike elevation of 1540 m (5053 ft), is less than 1.6 km (1 mi) west of the SDA, with an average elevation of 1524 m (5000 ft). Historically, the spreading areas have contained low levels of water or no water. A study was conducted to investigate the effects of a hypothetical failure of Dike #2 on the SDA (Martineau et. al., 1990). The study concluded the SDA perimeter dike would not be overtopped during a low breach outflow of 49 m^3/s (1733 ft^3/s) but was in danger of being overtopped from the high breach outflow of 78 m^3/s (2759 ft^3/s). Subsequent upgrades to the main ditch along Adams Boulevard; such as, removing culverts emplaced at high skew angles and replacing them with an open box culvert has reduced this possibility. From this study it was determined the safe capacity of the SDA peripheral drainage ditch is 1,567 cfs and

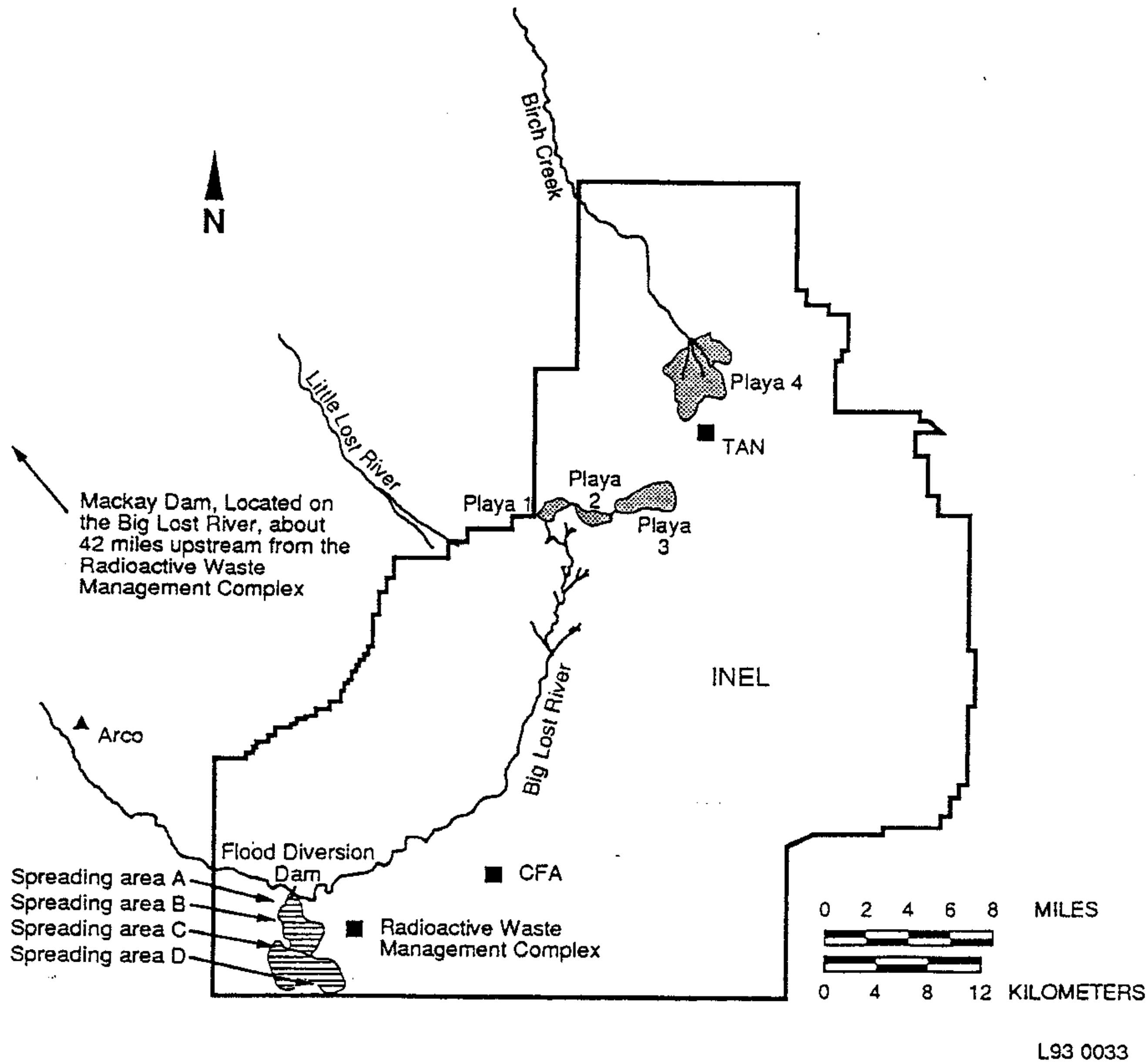


Figure 1. Big Lost River drainage basin.

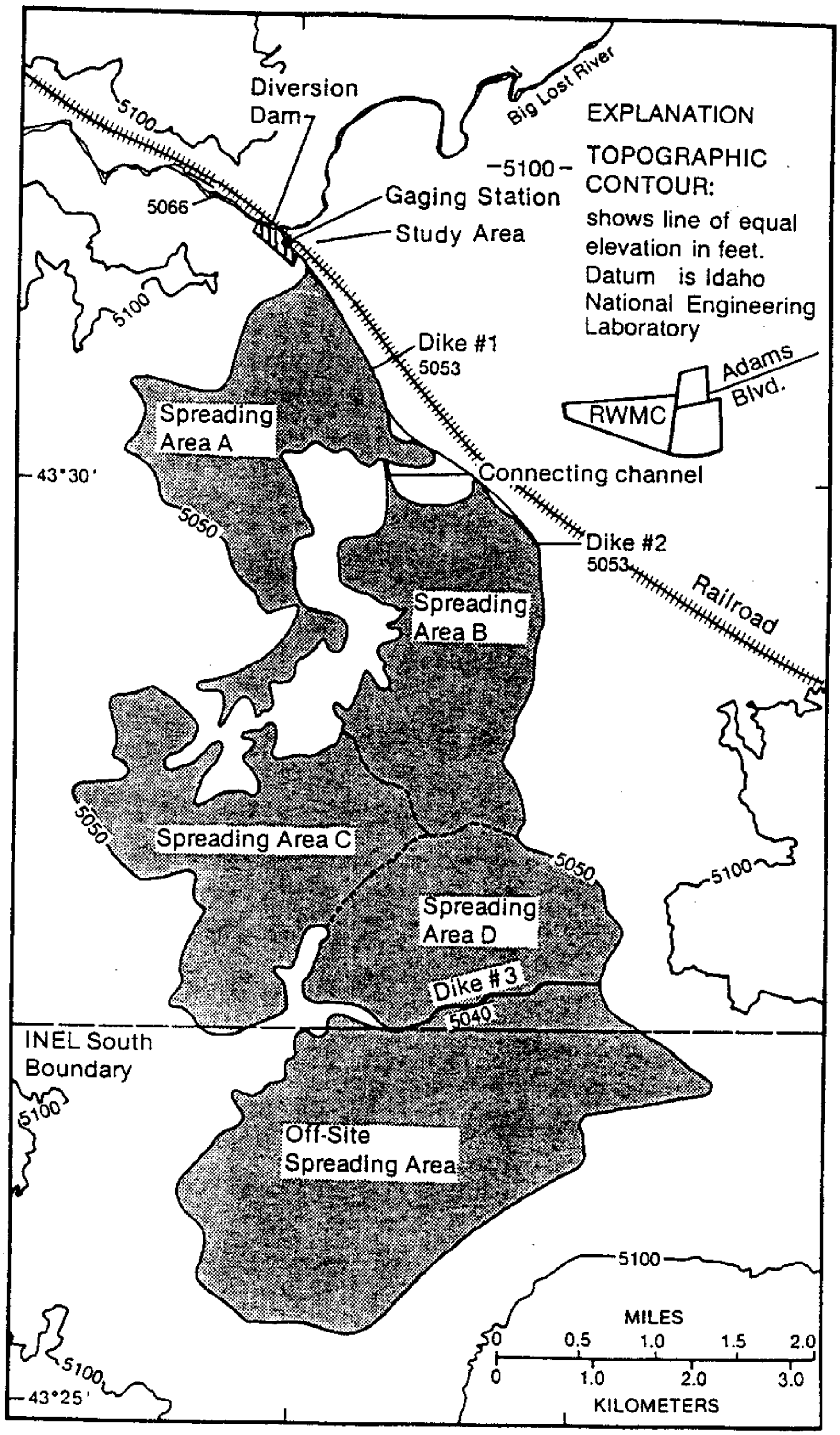


Figure 2. INEL diversion area.

the safe capacity of the main discharge channel along Adams Boulevard is 800 cfs. The existing SDA peripheral drainage ditch and the main discharge channel along Adams Boulevard are adequate to protect the SDA from the 100-, 500-, 1,000-, and 10,000-year combined rain-on-snow storm events (Dames & Moore, 1993).

The Big Lost River, 3.2 km (2 mi) north of the SDA, is at an elevation of 9-12 m (30-40 ft) higher than the SDA. However, the Big Lost River poses no flood threat to the SDA. The Big Lost River flows northeast, away from the SDA, to its termination in the playas. A detailed flood-routing analysis of a hypothetical failure of Mackay Dam resulting from hydrologic and seismic failures shows the RWMC would not be inundated by this severe flooding (Koslow and Van Haaften, 1986). Big Lost River flows have not entered the SDA during its entire operation which began in 1952. However, there is evidence of alluvial deposits in the SDA, possibly deposited during the Pleistocene period. A mineralogical correlation of surficial sediment from area drainages with sedimentary interbeds at the RWMC suggest that the present day drainage patterns of the streams may be similar to historical patterns (Bartholomay, 1990). A plot of the average percentages of total clay minerals plus mica, total feldspar, and carbonates of the sedimentary interbeds indicates that the interbeds at the RWMC are similar to the Big Lost River channel, overbank, and spreading area deposits (ibid). Similarities indicate that most of the sedimentary interbeds analyzed at the RWMC may be flood plain deposits of an early river containing sediments similar to the present day Big Lost River deposits. These correlations suggest that the sedimentary interbeds probably were deposited in a depositional basin similar to the present day basin.

Two eroded notches or wind gaps (one of which has been filled with earth material) in a basalt ridge (Quaking Aspen Butte basalt flow) west of the RWMC also suggest past surface water flows. There is evidence of glacial outburst flooding of the Big Lost River during the Pleistocene period (Rathburn, 1989 and 1991).

The past 10,000 years (i.e., the Holocene period, which follows the last glacial period) was a period of soil formation and limited erosion in the small valley in which the RWMC is located; and there appears to be a good prospect that this situation (of essentially no erosion) will continue at least until the next glacial period (Hackett et al., 1994). Regional tributary flooding has caused water to enter the RWMC basin on a number of occasions in Holocene time through the wind gaps in the adjacent Quaking Aspen Butte basalt flow, and have left a thin scattering of small (<2 mm) alluvial gravels just inside the basin near the wind gaps. Glacial outburst flooding inundated the RWMC during the late-Pinedale glaciation (about 20,000 years ago) eroding sediments from higher convex positions around the basin and depositing large basalt boulders within the basin. Nevertheless, substantial soil layers with ages ranging from about 20,000 to 120,000 years remain apparently undisturbed, indicating that significant erosion of older soils did not occur (Hackett et al., 1994). Climate changes during the approximately 10,000 years subsequent to the last glaciation have had little effect on the soil landscape within the RWMC basin; and so it appears that if climate fluctuations are within historical limits the same may be true for the next 10,000 years.

In summary, the Big Lost River is not a surface water flow path for contaminant transport at the SDA.

Local Basin Surface Runoff

The SDA is situated in a natural topographic depression at an average elevation of 1524 m (5000 ft). This natural depression tends to hold precipitation falling upon it and to collect additional runoff water from the surrounding slopes. The SDA has been flooded at least three times in past years (1962, 1969, and 1982) by local basin runoff. These flooding events were the consequence of rapid snowmelt combined with heavy rains and warm winds, resulting in runoff water from surrounding areas entering the SDA.

In February 1962, approximately 4.6 cm (1.81 in.) of rain fell on 20 cm (8 in.) of snow in three days. The top foot or so of undisturbed ground was frozen, resulting in an estimated 30 acre-ft of runoff entering the SDA (Karlsson, 1977). Pits 2 and 3 and Trenches 24 and 25, all of which were open to receive additional waste, became ponded with the runoff (Figure 3). Some boxes were broken open, and the radioactive contents, such as gloves and sample bottles, were distributed in undisturbed areas within the SDA. A radiation survey was immediately initiated. All contaminated items found outside a designated burial location were collected and redeposited in a pit or trench. All detectable surface contamination was confined to the SDA.

Water samples from monitoring wells immediately adjacent to trenches indicated no significant migration of radionuclides through the soil as a result of the flooded conditions (Karlsson, 1977). In response to this local flooding, dikes were constructed around the perimeter of the SDA to prevent local runoff from entering the SDA.

In January 1969, rainfall and snowmelt, amounting to about 4.3 cm (1.7 in.) of water, resulted in an estimated 20 acre-ft of local basin runoff ponding in the SDA (Karlsson, 1977). Large snowdrifts in the perimeter dike blocked the drainage flow path, resulting in runoff from the local basin to overflow the dike and enter the SDA. Pit 10 and Trenches 48 and 49, which were open to receive additional waste became ponded (Figure 4). Pit 9, which was partly open, also became ponded. After this flood, the dike around the SDA was raised and the perimeter drainage ditch was enlarged. The ditch was made large enough to permit heavy equipment in to remove snow drifts, if necessary.

In 1971, the SDA was graded to provide drainage channels for surface water runoff. An outlet pipe with a flap valve was placed through the dike in the northeast corner of the SDA to allow surface water to flow out and to prevent local basin surface runoff from entering the SDA.

On February 17, 1982, warm winds, heavy rains and, snowmelt from the local basin surrounding the SDA, resulted in an accumulation of water in the southeast corner of the SDA, causing a rupture of the perimeter dike. This rupture resulted in floodwaters entering Pits 16, 17, and 18 (Figure 5). About 8.3 acre-ft of runoff water entered the SDA and ponded in Pit 16. Again, snow and ice blocking the drainage channel resulted in a rupture of the perimeter dike. Pumps were placed into Pit 16, and the ponded water was pumped into the SDA outflow drainage ditch. Following the dike failure, ponded water in the SDA was sampled and analyzed for beta-gamma radiation using an alpha/beta proportional counter. On February 22, 1982, pumping was stopped because the beta-gamma count rate of water samples taken from Pit 16 were increasing. Only one sample from Pit 16, taken on February 23, exceeded limitations in DOE Order 5480.1 for radiological releases to an uncontrolled area. Water representative of the location where this sample was taken did not leave the SDA because pumping was stopped the day before (Halverson, 1983).

In response to the 1982 SDA local basin runoff flooding, two studies were conducted to determine the magnitude of a local basin flood, due to natural precipitation events, with a recurrence interval of 25 and 100 years (Koslow, 1982 and Truitt, 1984). These studies provided the framework for upgrading flood control measures at the SDA.

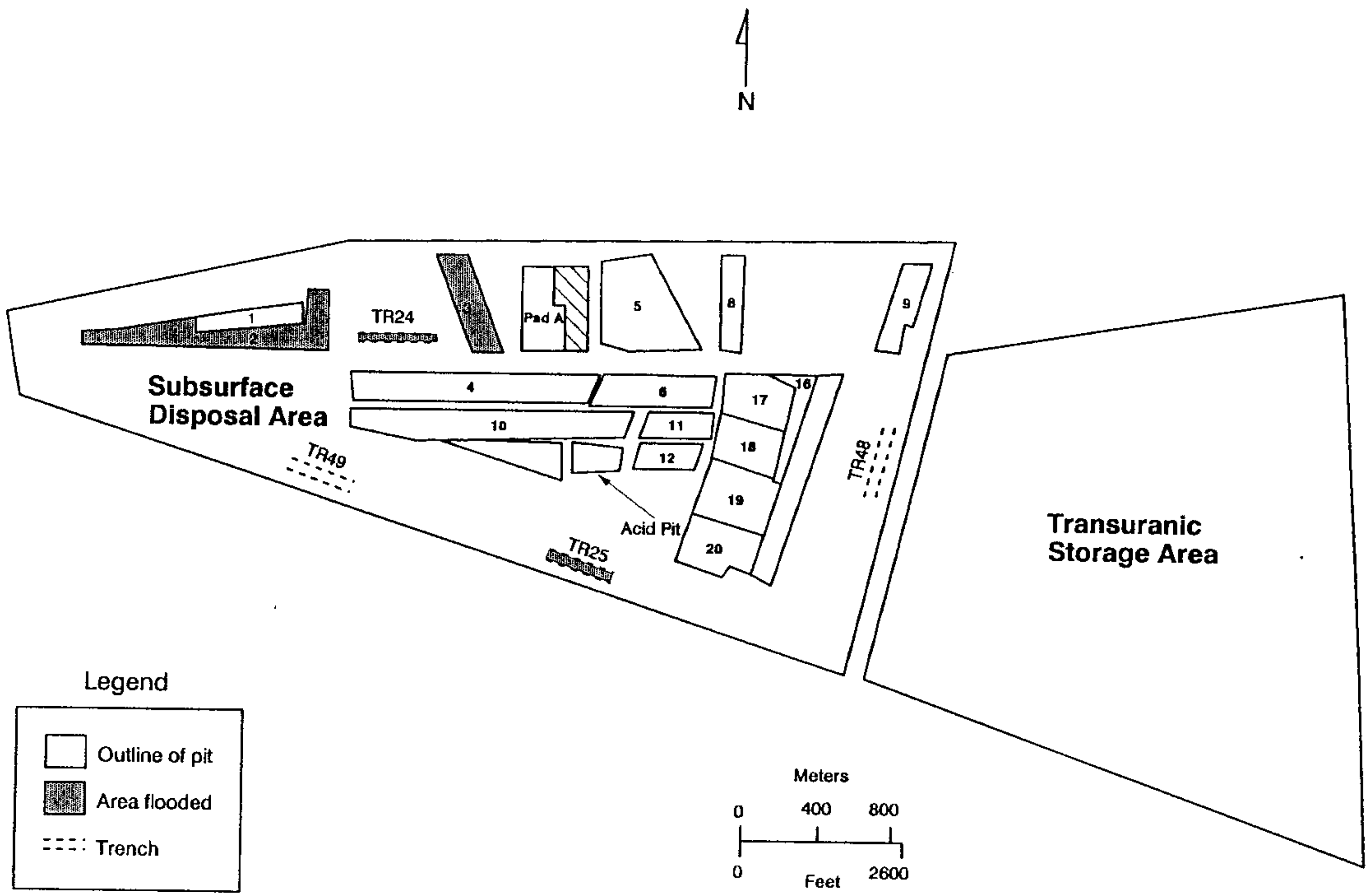


Figure 3. Areas flooded during the 1962 flood.

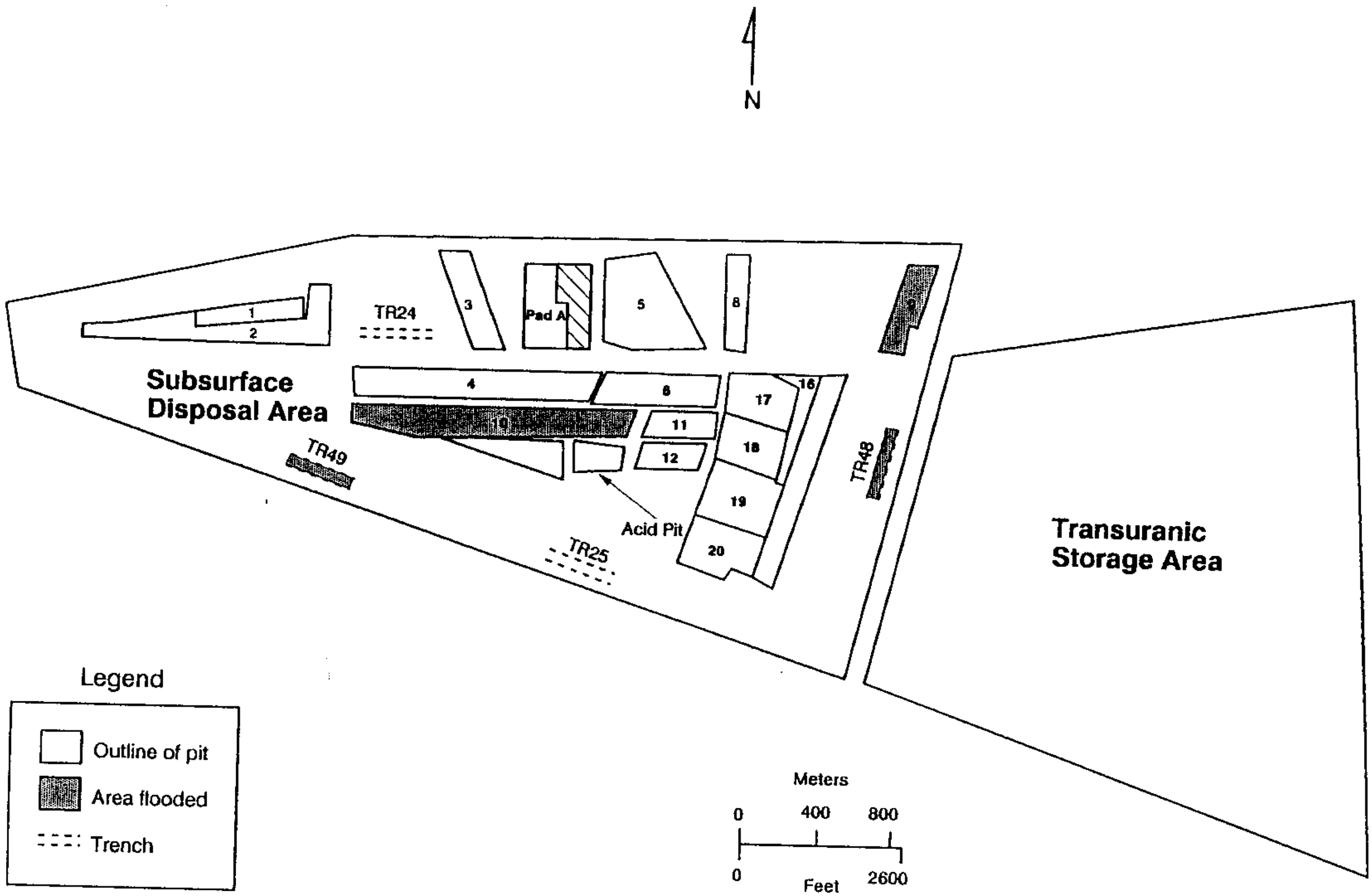


Figure 4. Areas flooded during the 1969 flood.

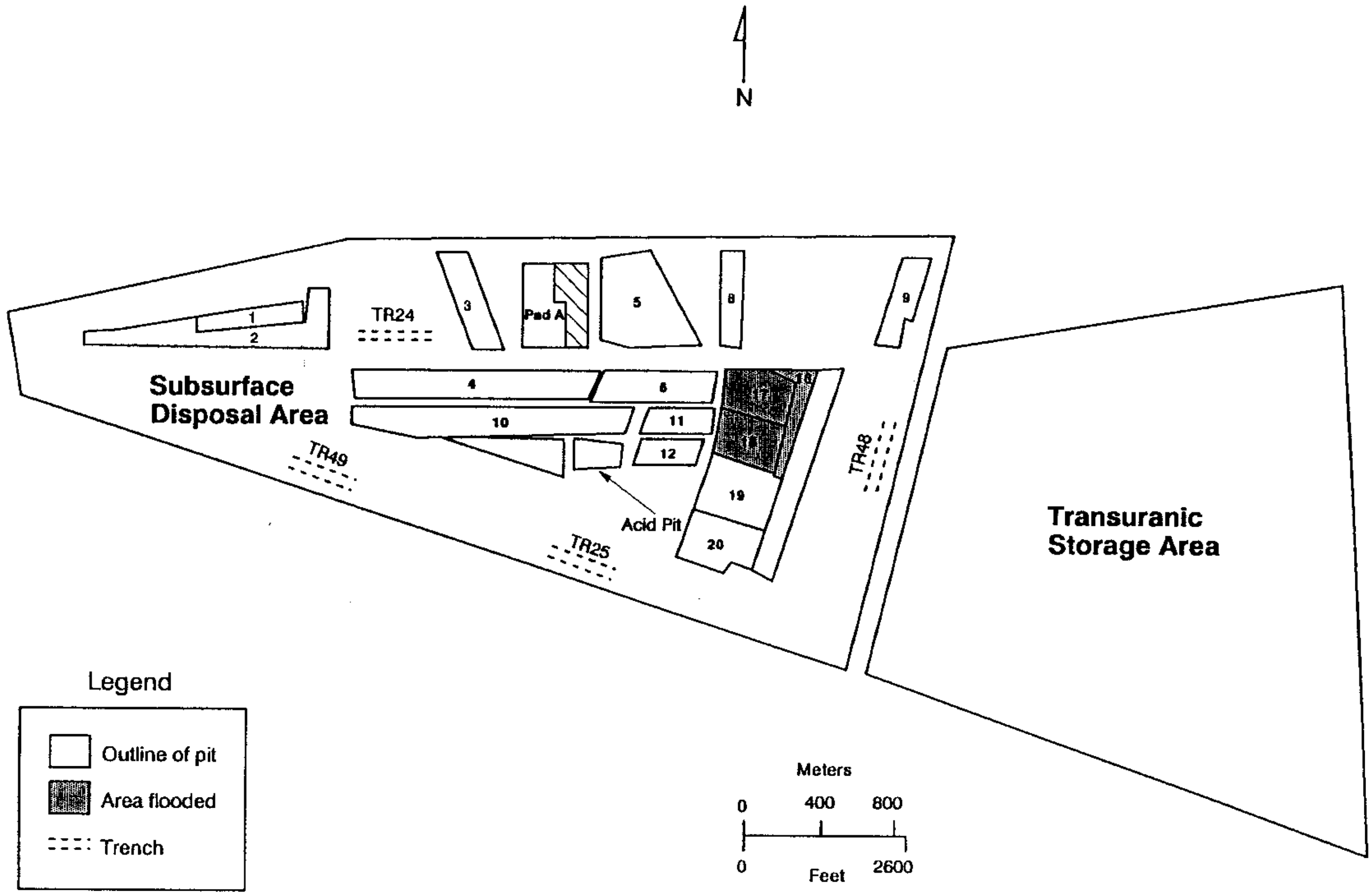


Figure 5. Areas flooded during the 1982 flood.

The first phase of work consisted of deepening and widening the perimeter SDA drainage channel around the SDA and outward to Adams Boulevard (Halverson, 1983). In all, approximately 3823 m^3 (5,000 yd^3) of soil was removed from the channels. Removal of soil from the channel disclosed basalt pinnacles in the channel impeding water flow. Blasting and removal of this basalt from the channel was subsequently conducted. Approximately 30,584 m^3 (40,000 yd^3) of soil was brought into the SDA and work was begun to raise the low-lying areas starting in the southeast end of the SDA.

Final improvements to the perimeter dike at the SDA were completed in 1988. These improvements consisted of raising the dike as much as 9 m (3 ft), widening the dike, and adding riprap. Recontouring work within the SDA added approximately 105,515 m^3 (138,000 yd^3) of fill to eliminate surface ponding and provide sufficient flow to the drainage ditch (Barnes, 1989).

A study was conducted in 1988 to evaluate the existing SDA cover and drainage system for reducing water infiltration into the SDA (Barnes, 1989). The study concluded that no new drainage improvements were recommended for the near-term, with the suggestion that this decision be reviewed on a yearly basis as new information on infiltration at the SDA is compiled.

In spite of the contouring efforts within the SDA, several small depressional areas, with minimal drainage to the drainage ditches, often result in ponding of precipitation. Further regrading efforts may be necessary to reduce standing meltwater and subsequent infiltration of the SDA soil cover. Upon closure, a final cover design should be considered to prevent further infiltration of precipitation and snowmelt from entering the SDA. Waste subsidence, causing cracking of cover soil will also result in increased permeabilities. Efforts to prevent waste subsidence and soil cracking should be made.

Localized runoff from the surrounding slopes is now prevented from entering the SDA by the perimeter drainage channel and dike surrounding the SDA (Figure 6). A design cross-section of the dike and perimeter drainage channel is shown in Figure 7. The present elevation of the top of this dike is about 1529 m (5015 ft), which ranges from 0.6 to 4.6 m (2 to 15 ft) above areas within the SDA. A dike within the SDA, with a top elevation ranging from 1528 to 1529 m (5013 to 5015 ft) has been constructed around the active pit in the southeastern part of the SDA. Both dikes are protected from erosion by coarse riprap. The implementation of these flood control measures has proven successful in diverting local basin runoff and greatly reducing the risk of flooding.

Local runoff from within the SDA flows to a sampling/discharge outlet on the east end of the SDA. The outlet consists of a sump pump capable of pumping 250 gpm, a catch basin that collects waters above the pumping rate, and two 46 cm (18-in.) culverts with a gate valve and flapper valve to prevent outside waters from entering the SDA. This outlet directs waters to the RWMC drainage channel, which drains across the RWMC administrative area northeast, crossing Adams Boulevard, to a drainage basin that drains to the Big Lost River (Figure 6). Based on available information, surface runoff from the SDA and surrounding slopes infiltrates the soils and/or evaporates; prior to reaching the Big Lost River.

Management at the RWMC has implemented a storm water pollution prevention plan to ensure that the storm water runoff from the facility to the environment does not contain contaminants that would be detrimental to surface water, groundwater, or the environment (LITCO, 1995). This plan invokes the final *National Pollutant Discharge Elimination System General Permits* for storm water associated with industrial activity and specifies the management practices that the RWMC uses to control the routine and nonroutine discharge of pollutants.

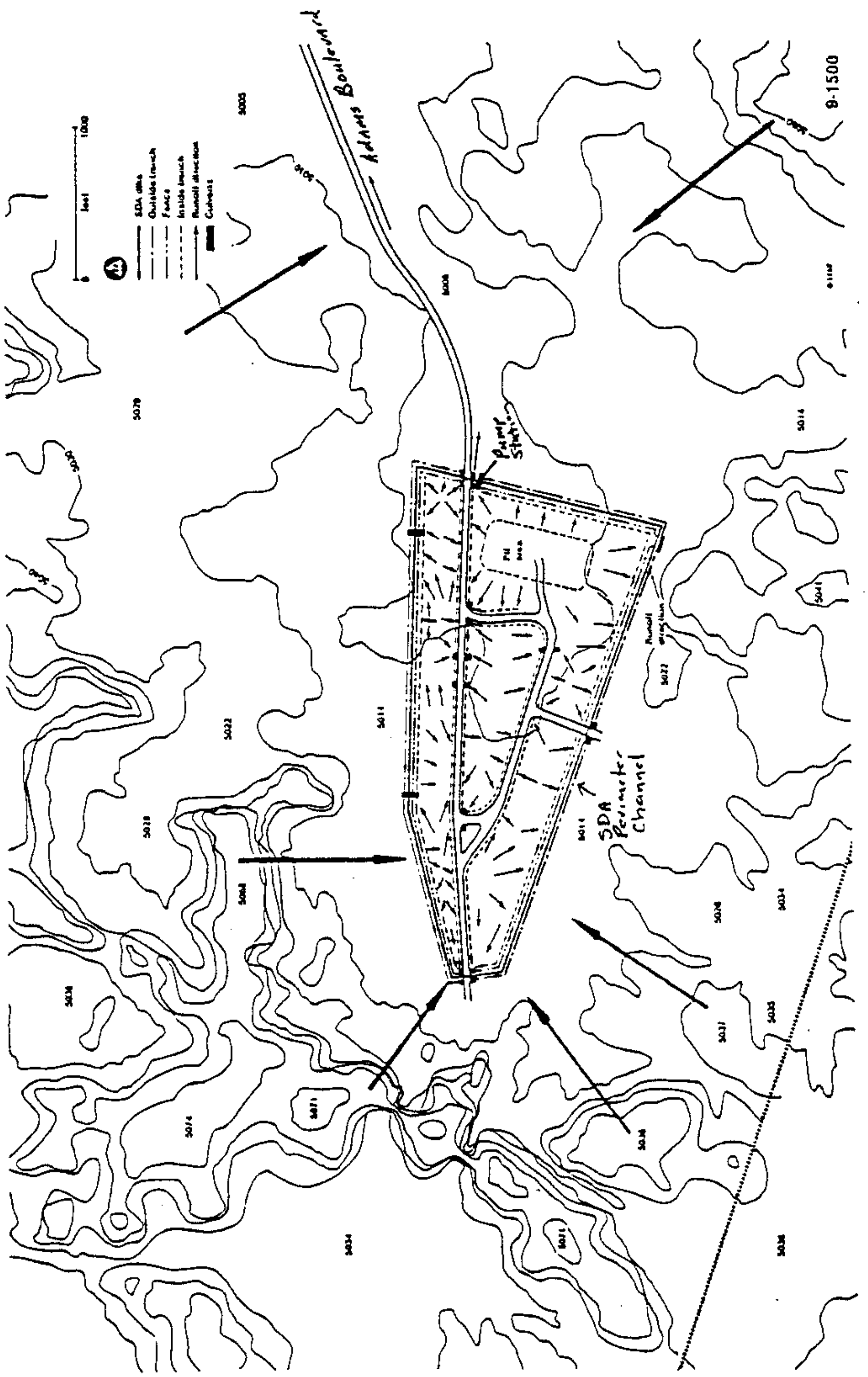
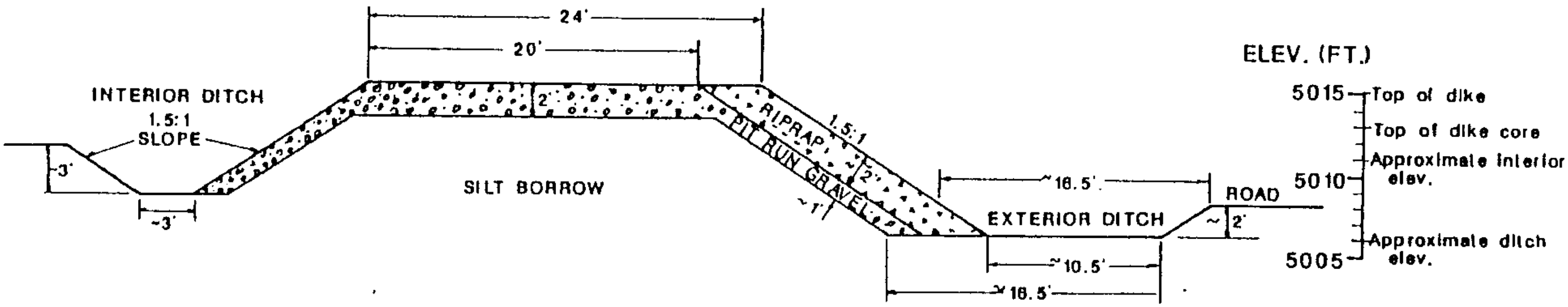


Figure 6. Surface drainage patterns and drainage controls at the SDA.



NOTES:

1. Figure represents design section, not as-built.
2. Interior ditch section was nominal assumed geometry and does not represent proposed design.
3. Based on EG & G drawing number 169199, attachment 2 of RFP No. C86-131159.

Figure 7. SDA typical dike and perimeter drainage cross-section.

The *Radiological Environmental Surveillance Program*, as conducted by the *LITCO Environmental Monitoring Unit*, conducts surface water runoff sampling quarterly at the RWMC. Water samples are collected from the SDA sump pump area, when there is a sufficient amount of water to be collected, usually following periods of rainfall or snowmelt for analysis of gross alpha, beta, and gamma spectroscopy, and selected radiochemistry (Figure 8). Radionuclide concentrations in runoff water are analyzed to determine if radionuclide transport from the area is occurring during runoff conditions. These results are summarized in annual reports entitled *Environmental Surveillance for LITCO Waste Management Facilities at the Idaho National Engineering Laboratory*. Monitoring results to date indicate radionuclides detected are at or near background levels and well below derived concentration guides.

Precipitation

The mountains to the west and north of the INEL purge the air masses of available moisture, resulting in an arid to semiarid climate. The annual average total precipitation is 22 cm (8.71 in.), measured at CFA, a station approximately 6.4 km (4 mi) northeast of the SDA (Clawson et al., 1989). The maximum measured daily precipitation is 4.2 cm (1.64 in.) (ibid.). A pronounced precipitation peak occurs in May and June, with an average of 3 cm (1.2 in.) for each of these months, due to thunderstorms (ibid). The maximum 1-hr precipitation is 1.4 cm (.54 in.), again occurring typically in May or June, due to thunderstorms. The wettest year of record results in 37.3 cm (14.7 in) of precipitation (ibid).

Snowfall is a major contributor to the total yearly precipitation. The annual average snowfall is 70 cm (27.6 in.) with a maximum measured yearly snowfall of 152 cm (59.7 in.) (ibid.). The maximum average monthly snowfall is 16 cm (6.4 in.), occurring in December and a maximum monthly snowfall of 56.6 cm (22.3 in.), again occurring in December (ibid.). The maximum 24-hr snowfall is 21.8 cm (8.6 in.) occurring in March. The water content of the melted snow probably contributes between a quarter to a third of the annual average 22 cm (8.71 in.) of precipitation.

The mean two year surface runoff event within the SDA, consisting of snowmelt and precipitation, is 15 acre-ft of water (Koslow, 1983).

A study using meteorological data from the CFA for the period 1950 through 1990 was compiled and a statistical analysis performed to determine the 25- and 100-year, 24-hour precipitation and the 25- and 100-year snow depths on the ground for the RWMC (Sagendorf, 1991). Results from the study indicate 3.43 cm (1.35 in.) of precipitation for a 25-year, 24-hour storm event and 4.06 cm (1.6 in.) of precipitation for a 100-year, 24-hour storm event. The expected 25-year and 100-year snow depth is 57.4 and 77.7 cm (22.6 and 30.6 in.), respectively.

Infiltration

Infiltration involves three interdependent processes: entry through the soil surface, storage within the soil, and transmission through the soil. The soil cover at the SDA is composed of fluvial and lacrustrine deposits taken from the INEL Spreading Areas A, B, C, D (Figure 2). The closest Spreading Area B, is less than 1.6 km (1 mi) from the SDA, and is the main source area for the SDA soil cover material. The texture of the deposits is heterogeneous and consists of a mixture of sand, silt, and clay (Binda, 1981). The deposits are removed from the source area with a scraper. The transported material is then used to backfill the waste burial trenches and pits. The final layers of soil cover are placed with a scraper and then graded. Overall compaction of the soils has been

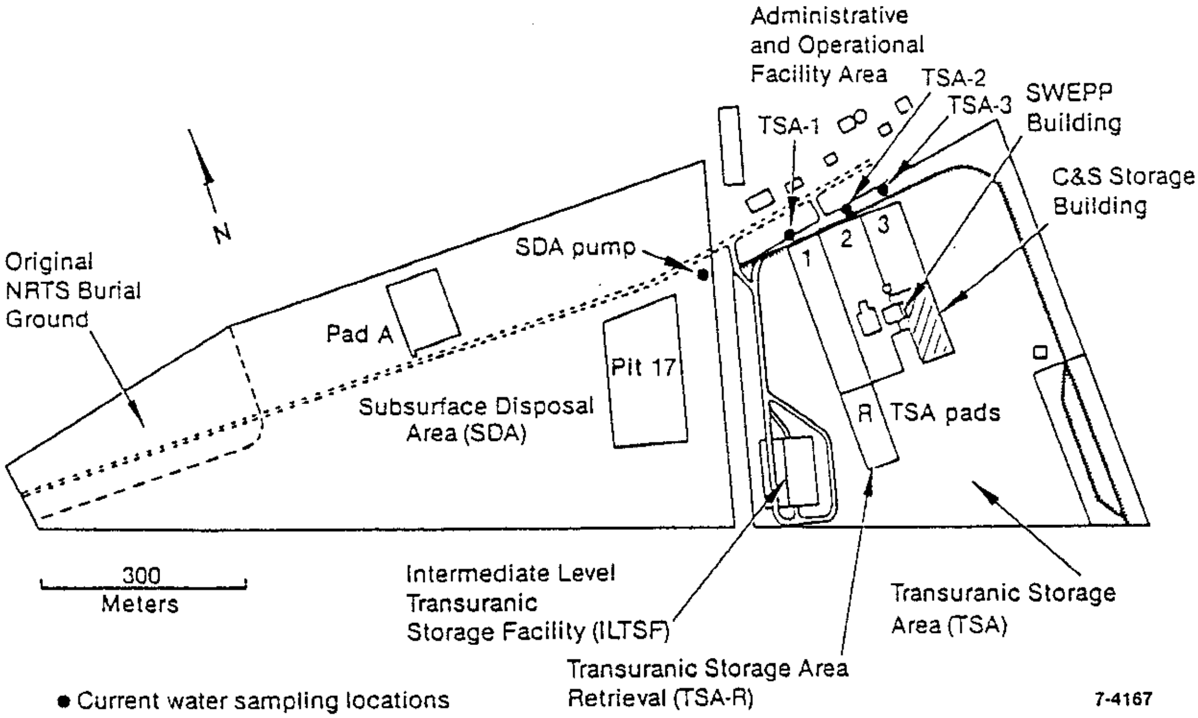


Figure 8. Surface water sampling locations.

inconsistent (Barnes, 1989). It is not uncommon for a mixture of gravel/cobbles to be placed over the soil cover in certain areas to facilitate driving over the area. Crested wheatgrass (Agropyron cristatum) is planted to control erosion of the soil cover and increase water uptake. Thedepth of the soil cover over filled pits and trenches ranges from 0.5 m (1.5 ft) in a few areas to over 1.8 m (6 ft)(Barnes, 1989).

Potentially, the greatest risk of abnormal amounts of water entering the SDA cover is with the simultaneous occurrence of heavy rainfall and melting snow. Past flooding events at the SDA were the result of local basin runoff generated from heavy rainfall and snowmelt. This type of flooding has been alleviated to a great extent through upgrades to the SDA flood control system. It is unlikely that a flood event of this nature will adversely impact the SDA with the improved drainage controls of raising the dike 0.9 m (3 ft), widening it and adding rip-rap. The present elevation of the dike is 1529 m (5015 ft). Precipitation directly falling on the SDA and snow accumulation on the surface do pose a risk for subsequent infiltration of meltwater into the SDA cover.

A small percentage of the ditches within the SDA lie directly over waste and a third of the ditches are located near waste boundaries. The ditches are typically 0.73 m (2.4 ft) deep with a bottom width of 0.3 to 0.6 m (1 to 2 ft) and side slope of 1H:1V. Ice may build up in the ditches in the winter months, decreasing the flow capacity. In an extremely wet year water may pond in the ditches for up to a period of two weeks (Barnes, 1988). Infiltration into the SDA cover may occur during these wet periods, during the months of December through May.

A hydrologic simulation of PAD A using CREAMS 1.8 and an assumed 500-year precipitation event characterized by (a) a maximum yearly precipitation of 63.5 cm (25-in.), (b) a maximum monthly precipitation for the month of May of 12.7 cm (5-in.), and (c) a maximum 24-hr precipitation of 7.6 cm (3-in.); was made (Crockett, 1985). This study concluded a fair stand of grass in 0.6 m (2 ft) of uncompacted soil appears adequate to remove almost all water in the soil cap even under a 500-yr precipitation event. However, the model did not consider soil cracking, subsidence, and animal intrusion.

A study conducted in 1987 by Golder & Associates evaluated the present SDA cover. The study concluded the cover was susceptible to subsidence, poor in terms of preventing water infiltration and plant and animal intrusion. The infiltration rates vary from area to area, but it was concluded as much as five to seven inches of water per decade has infiltrated the SDA cover. Ten to 30% of the SDA cover readily allows for infiltration, in particular in areas near drainage ditches, depressions subject to ponding, and areas of shallow cover and a high sand content.

A study was performed to describe the areal variations of the SDA soil cover's hydraulic characteristics (Borghese, 1988). The results of this study are inconclusive with regards to areal variations or trends of hydraulic characteristics. Vertical variations of hydraulic characteristics were minimal. The highest K values were found in the first 5 to 15 cm (2 to 6 in.) of the soil cover, probably due to the interval being in the rooting zone of the cultivated grasses (Borghese, 1988). The K values for the saturated hydraulic conductivities ranged from a maximum of 8.4×10^{-2} cm/s and a minimum of 7.7×10^{-6} cm/s.

Vadose zone instrumentation indicates wetter areas occurred where water collected at land surface during portions of the year; such as, along drainage and flood control ditches, small depressions where runoff or snowmelt accumulates, and areas flooded in the past (Laney et al., 1988 and McElroy, 1990). Flux calculations show that fluxes in the wetter areas can be as much as three orders of magnitude larger than in dry areas, and in some spots may approach 18 m/yr (61 ft/yr).

The average range of matric potentials for surficial soils is from saturation to -3.0 bars (McElroy and Hubbell, 1989). Neutron data indicated an active zone of moisture in the sediments extends to a depth of 1.8 to 2.1 m (6 to 7 ft) below land surface (Laney et al., 1988). Monitoring of two neutron access tubes in 1993 indicated varying net infiltration of 3 and 27.7 cm (1.2 and 10.9 in.) for the two tubes and an active zone of moisture down to a depth of 3 m (10 ft) at one of the monitoring loctions (McElroy, 1993). Infiltration rate estimates from grouping of non-compacted samples collected from the 240 ft interbed of boreholes drilled beneath the SDA resulted in 3.8 and 9.2 cm/yr (9.6 and 23 in./yr) (Magnuson and McElroy, 1993).

Hubble (1993) presents water level monitoring data for perched water at the surficial sediment-basalt contact from two wells that show a response to early summer precipitation events as well as the more significant infiltration events due to snowmelt. This indicates a potential in some locations (i.e. along ditches and low-lying areas) for precipitation other than snowmelt to also possibly contribute to contaminant transport in the subsurface.

Stable isotope and chemical data suggest that perched water above the 73 m (240 ft) interbed under the SDA is due to lateral flow of water that has infiltrated from the diversion of Big Lost River flows to the spreading areas, with only minor contributions from atmospheric precipitation through the SDA cover (Rightmire and Lewis, 1987). Perched water above the 33 m (110 ft) interbed did not show any contribution from the spreading areas.

Conclusions and Recommendations

In summary, the Big Lost River does not pose a flood threat to the SDA and is not a surface water pathway for contaminant transport at the SDA. The Big Lost River flows to the northeast, away from the SDA, with no real drainage to the SDA. The diversion of Big Lost River flows to the spreading areas results in infiltration of the ponded waters, which may influence the perched water near the SDA and definitely can influence the ground water flows in this area, causing localized ground water flow reversals.

Local precipitation falling directly on the SDA cover and localized runoff are the most probable forms of surface water to effect the SDA. Radionuclides detected in surface water runoff at the SDA are at or near background levels and well below derived concentration guides. However, local surface water runoff within the SDA may pond in depressional areas and infiltrate the surface soils. This may result in perched water layers beneath the SDA, and this provides a possible transport mechanism to the groundwater. Precipitation directly falling on the SDA cover may also infiltrate the soils and provide a water pathway for the transport of contaminants, but to a much lesser extent than surface water runoff ponding on the surface during the winter months. Due to the arid and semi-arid nature of the site, it is unlikely heavy precipitation will be of a great concern. However, several discrete events closely spaced may result in pulses of water infiltrating the soil cover and possibly contacting the waste.

A low permeability final cover design should be considered for the SDA cover upon closure. The final cover over all trenches and pits should be graded to minimize the residence time and flow path length of surface water runoff generated from precipitation falling on the landfill surface.

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SURFACE WATER DATA

Introduction

Management at the RWMC has implemented a storm water pollution prevention plan to ensure that the storm water runoff from the facility to the environment does not contain contaminants that would be detrimental to surface water, groundwater, or the environment (LITCO, 1995). This plan invokes the final *National Pollutant Discharge Elimination System General Permits* for storm water associated with industrial activity and specifies the management practices that the RWMC uses to control the routine and nonroutine discharge of pollutants.

In conjunction with this plan the *Radiological Environmental Surveillance Program*, as conducted by the *LITCO Environmental Monitoring Unit,* conducts surface water runoff sampling quarterly at the RWMC. The objectives of the monitoring of RWMC surface water are to: (a) determine concentrations and total amounts of radionuclides in any surface waters leaving the RWMC, and as an interim measure, compare against derived concentration guides (DCGs) for limits set for release to the public, (b) detect significant trends of radionuclide concentrations in surface water, (c) provide an indication of confinement integrity for waste at TSA and SDA, and (d) provide some of the data needed for pathways-analyses of radionuclide concentrations in surface water which can be used for estimating dose to humans.

Surface Water Runoff Collection

Water samples are collected during each quarter during which sufficient rain falls or snow melts to produce runoff from the TSA asphalt pads and in the SDA gate ditch. One sample is collected from each of the four culverts that drain off the TSA asphalt pads. These four samples are upstream from a drainage ditch. In addition, a sample is taken at the point of discharge from the SDA near the sump pump. Figure 1 shows sample locations, including the four TSA culverts (TSA-1, TSA-2, TSA-3, and TSA-4) and the SDA pump. Each sample is collected in a 4-L (1-gal) polyethylene container, preserved with acid, added filter paper pulp tablets, sealed, dated, and location identified. The *Radiation Measurements laboratory* analyses the samples by means of gamma spectrometry for gross alpha, beta, and gamma radionuclides. The analyses are performed on both the liquid and particulate fractions. Detection limits for specific radionuclides analyzed for are listed in Tables 1, 2, and 3. Results are summarized in annual reports entitled *Environmental Surveillance for LITCO Waste Management Facilities at the Idaho National Engineering Laboratory* (Wilhelmsen et al., 1994) and are stored in a computer database that may be accessed by contacting the *LITCO Environmental Monitoring Unit.*

Surface water runoff draining from the SDA is pumped into the SDA/TSA drainage ditch. Sampling at this point allows a direct assessment of radionuclide migration from the SDA via surface water runoff. Sampling at the TSA-1, TSA-2, TSA-3, and TSA-4 culverts allows similar assessments of these areas. Control samples are collected to determine background concentrations of the radionuclides of interest in locations unaffected by facility operations. Prior to 1984, the control sample location was from the Big Lost River, which is now not considered to be representative of background surface water runoff at the RWMC, therefore the control location has been changed to a ponding area 2 km (1.2 mi) north of the RWMC.

Summary

Generally, most concentrations of radionuclides detected in surface water at the RWMC are at or near background levels found in the vicinity of the RWMC. Each detection found above background level was at a small fraction of the applicable DCG. DOE facilities generally compare results from permanent surface waters (i.e., river, lakes, and springs) with DCGs. The DCGs are used as a point of reference only. Comparison of individual measurements to the DCGs gives the maximum dose a person could receive at the location where the sample was collected, given the following two assumptions: (a) the concentration was at the DCG level continuously for the entire year, and (b) the person receiving the exposure was at that location for the entire year, continually drinking the water or inhaling the air. This is a very conservative approach and is used only as an alert measure, as RWMC surface water samples are collected on-Site and not at the receptor of the maximally exposed individual.

Although the pumped runoff water from the SDA may be a pathway for the transport of radionuclides, the concentrations detected to date (1978 to present) are representative of background levels and do not represent a hazard to personnel or the off-site population.

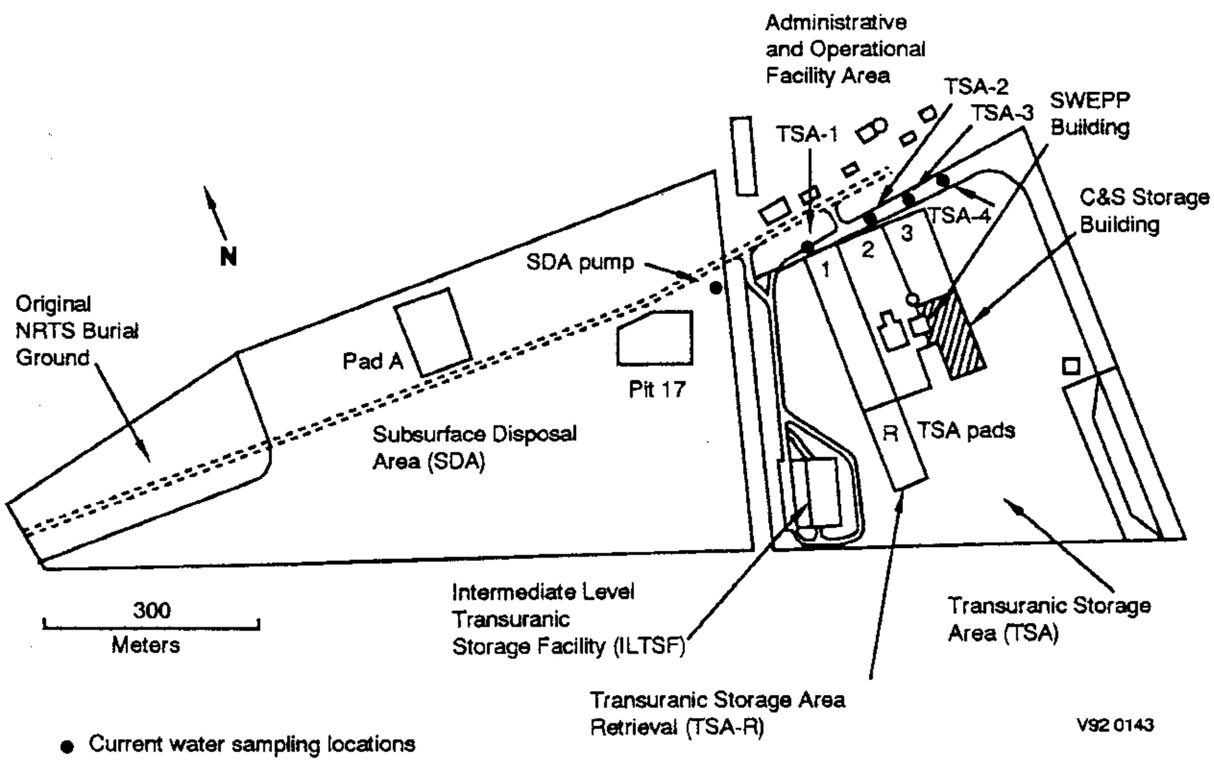

Figure 1. Sampling locations at the RWMC for surface water runoff.

Table 1. Environmental monitoring samples for radiochemical analysis.

Media	Sample Description	Method of Treatment	Detection Limits (μCi/g or mL)	
Air	Sampled approximately at 4 cfm for 2 weeks on Versapor 1200 filters, 6 filters per quarter for a total of ~1.7×10^{10} cc of air.	Dry ash, dissolve and analyze the total sample of 6 filters.	Sr–90 Pu–238 Pu–239 Am–241	2×10^{-16} 2×10^{-18} 2×10^{-18} 2×10^{-18}
Water	4–L collapsible polyethylene container containing 25 mL of conc. HNO_3 and 2 Whatman ashless filter tablets for 4000 mL water.	Separate and dissolve paper pulp, reconstitute sample, and boil down to 100 mL. Analyze 1/2 sample or 2–L equivalent.	Sr–90 Pu–238 Pu–239 Am–241	2×10^{-9} 2×10^{-11} 2×10^{-11} 2×10^{-11}
Soil	At least 25 g in appropriate container. Larger quantities are permissible if convenient.	Analyze 10–g sample.	Sr–90 Pu–238 Pu–239 Am–241	3×10^{-7} 3×10^{-9} 3×10^{-9} 3×10^{-9}
Vegetation	16–oz squat jar filled to rim below threads (avg wt 150 g).	Dry ash and dissolve the total sample completely. Analyze the equivalent of 50 g of original sample.	Sr–90 Pu–238 Pu–239 Am–241	6×10^{-8} 6×10^{-10} 6×10^{-10} 6×10^{-10}
Animal Tissue	16–oz squat jar containing 10 dried deer mice, or 1 dried ground squirrel (avg wts: mice, 170 g; squirrel, 100 g).	Dry ash, dissolve, and analyze the equivalent of 50 g of the original sample.	Sr–90 Pu–238 Pu–239 Am–241	3×10^{-8} 3×10^{-10} 3×10^{-10} 3×10^{-10}

Table 2. RESP air, water, and soils samples for gamma spectrometry.

	Air Filters		Water Filtrate		Water Insoluble		Soils	
Radionuclides	10^{-9} pCi/mL	Total pCi	10^{-2} pCi/mL	Total pCi	10^{-4} pCi/mL	Total pCi	pCi/g	Total pCi
Sc–46	1	6	0.2	8	5	2	0.19	120
Cr–51	5	30	1.1	44	20	8	0.5	300
Mn–54	0.5	3	0.5	20	3	1.2	0.1	60
Co–58	0.5	3	0.09	3.6	4	1.6	0.1	60
Fe–59	0.9	5.4	1.5	60	7	2.8	0.11	60
Co–60	0.8	4.8	0.8	32	6	2.4	0.2	120
Zn–65	1	6	0.5	20	15	6	0.2	120
Nb–94	0.5	3	0.15	6	4	1.6	0.1	0.6
Nb–95	0.5	3	0.11	4.4	80	32	0.1	0.6
Zr–95	0.8	4.8	0.3	8	7	2.8	0.11	0.6
Ru–103	0.7	4.2	0.16	6.4	4	1.6	0.1	0.6
Ru–106	5	30	0.12	4.8	40	1.6	0.5	300
Ag–110m	0.5	3	0.15	6	5	20	0.1	60
Sb–124	0.5	3	0.13	5.2	5	2	0.1	60
Sb–125	1.5	9	0.3	12	15	6	0.2	120
Cs–134	0.6	3.6	0.09	3.6	4	1.6	0.1	60
Cs–137	0.8	4.8 5E-14	0.3	12	20	8	0.1	60
Ce–141	0.9	5.4	0.3	12	6	2.4	0.1	60
Ce–144	5	30 1E-14	1.0	40	20	8	0.4	240
Eu–152	2	12	0.5	20	15	6	0.2	120
Eu–154	2	12	0.3	12	15	6	0.3	180
Eu–155	2	12	0.8	32	10	4	0.3	180
Hf–181	0.6	3.6	0.12	4.8	6	2.4	0.1	60
Ta–182	0.9	12	0.5	20	20	8	0.4	240
Hg–203	0.5	3	0.15	6	2	0.8	0.1	60
Am–241	4	24	1.5	60	40	16	1.2	700
Gross Beta	9.5							
Gross Alpha	3.3							

Table 3. Description of environmental monitoring samples for gamma spectrometry analysis.

Media	Sample Description	Conditions of Counting
Air	Sampled at approximately 4 cfm for 2 weeks on 4–in. Versapor 1200 membrane filters for a total of 3×10^9 cc per filter.	Monthly composite samples of two 4–in. filters containing a total of about 6×10^9 cc of air are held flat over the detector and counted for 12 to 16 hours dependency on the detector system used.
Water	4–L collapsible polyethylene container containing 25 mL of conc. HNO_3 and two Whatman ashless filter paper tablets for 4000 mL of water.	The sample is shaken vigorously to dislodge all material from the sides and bottom of the container and filter. The filtrate is transferred to a 4–L Marinelli beaker and counted for 16 hours. The filter and paper pulp are also counted for 16 hours in contact with detector. Sample size, 4000 mL.
Soil	16–oz squat jar filled to the bead below the threads after settling.	The sample is counted in the squat jar for 2 hours with the jar being rotated as close to the detector as possible. Sample size approximately 700 g.
Vegetation	16–oz squat jar filled to the bead below the threads after settling.	The dry sample is counted in the squat jar for 16 hours with the jar being rotated as close to the detector as possible. Sample size about 150 g, average.

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